AGU FALL MEETING
San Francisco | 14 – 18 December 2015

B33C-0671: The effect of drought on carbon storage capacity in a tropical rainforest in French Guiana

Wednesday, 16 December 2015
13:40 - 18:00
Moscone South - Poster Hall

In a perfect-deficit approach (Yi, 2012), the daily maximum carbon storage capacity (CPC) of a given ecosystem for each year defines the perfect annual CPC curve. Deficits are the differences in the daily observational data for a given year against a perfect curve. The area between this curve and instantaneous canopy photosynthetic rates represents the potential productivity. Using an 11-year (2004 – 2014) eddy covariance flux and meteorological data, this perfect-deficit approach was used to examine the relationship between potential productivity and droughts occurring in 2005 and 2010 in a tropical rainforest of French Guiana, South America. Surprisingly, CPC deficits were only reduced by 24% (2005) and 19% (2010) from their respective perfect CPCs, indicating a subtle effect of drought to ecosystem productivity. Highest precipitation occurred in 2010 but precipitation deficits dropped drastically during this year (71% reduction from its perfect value) which reflects a drought condition. However, its deficits showed no correlation annually and seasonally. Soil water content (SWC) appeared to be the single driver for CPC deficits during long dry periods but is weakly correlated (r = 0.30; P <0.01 and r = 0.31; P <0.01, in 2005 and 2010, respectively). These results indicate that soil water is not a major limiting factor for productivity of this ecosystem during drought periods. In contrast, global radiation (Rg) corresponds to the peak of CPC deficits in 2010, but only 19% had been reduced from its ideal value. Yet, highest gross primary production (GPP) of 4106±231 $gCm^{-2}yr^{-1}$ occurred this year (mean 3753±231 $gCm^{-2}yr^{-1}$). Therefore, smaller deficits in Rg coupled with sufficient water may have induced higher productivity in 2010. Nevertheless, weaker correlations between potential productivity and climatic drivers may imply that other controlling aspects such as biological constraints may also have an effect to the dynamics of potential productivity during drought events, hence, must also be considered.

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